UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/634,764	08/07/2000	Ingrid B. Carlbom	2925-451P	3428

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HARNESS, DICKEY & PIERCE, P.L.C.
P.O. BOX 8910
RESTON, VA 20195

EXAMINER
PHAN, THAI Q

ART UNIT	PAPER NUMBER
2123	

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Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 07-01)

Application No.	Applicant(s)
09/634,764	Carlbom et al.
Examiner	Art Unit
Thai Phan	2123

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE ___3___ MONTH(S) FROM
THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on *Aug 7, 2000* _____ .

2a) ☐ This action is **FINAL**.   2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) *1-34* _____ is/are pending in the application.

    4a) Of the above, claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) *1-34* _____ is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☐ The drawing(s) filed on _____ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.

    If approved, corrected drawings are required in reply to this Office action.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a) ☐ All b) ☐ Some* c) ☐ None of:

      1. ☐ Certified copies of the priority documents have been received.

      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .

      3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    *See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

    a) ☐ The translation of the foreign language provisional application has been received.

15) ☒ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____

4) ☐ Interview Summary (PTO-413) Paper No(s). _____

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other:

DETAILED ACTION

This Office Action is in response to patent application S/N: 09/634,764, filed

on 08/07/2000. Claims 1-34 are pending in this Office Action.

Drawings

1.   Formal drawings filed on Feb. 27, 2001 are accepted.

Claim Rejections - 35 USC § 112

2.   The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming
> the subject matter which the applicant regards as his invention.

3.   Claim 29 recites the limitation "the constructed beam tree" in line 7. There is insufficient

antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

4.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth
> in section 102 of this title, if the differences between the subject matter sought to be patented and the prior
> art are such that the subject matter as a whole would have been obvious at the time the invention was made
> to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be
> negatived by the manner in which the invention was made.

5.   Claims 1-4, 6-11, 18-21, and 23-28 are rejected under 35 U.S.C. 103(a) as being

unpatentable over Nagamitsu et al., US patent no. 5,467,401.

As per claim 1, Nagamitsu discloses a sound environment simulator for measure of sound

wave effects with feature limitations very similar to the claimed invention (Abstract and

Summary of the Invention). According to Nagamitsu, the method of modeling sound wave

propagation in the spatial 3-dimensional environment includes steps of

computing wave propagation paths from sources to other regions in the spatial

environment (col. 5, lines 1-22, col. 6, line 16 to col. 7, line 45, for example),

generating at least reverberation or echo path between the source and a receiver based on

at least one computed wave propagation path as claimed (Figs. 9, 10, col. 8, line 49 to col. 9,

line 10, for example). Nagamitsu discloses impulse responses for each incident location, incident

direction, and sound bands (col. 8, line 66 to col. 9, line 10, for example) and ordering of sound

waves (col. 10, lines 47-52) based on weight corresponding to the arrival time for sound ray

tracing (col. 8, lines 39-41). Nagamitsu does not expressly disclose priority order of computing

wave propagation as claimed.

Practitioner in the art at the time of the invention was made could have found Nagamitsu

disclosure of ordering of reflection of incident waves including weight assigned to arrival time,

and computing wave responses for all incident waves for each direction as in cols. 8, 9, and 10

would obviously imply the claimed limitation of priority order of computing wave propagation in

order to reduce memory capacity and faster simulator in sound environment as disclosed in col.

10, lines 2-11, lines 30-35, lines 43-45, for example.

As per claim 2, Nagamitsu discloses method of modeling acoustic wave propagation in 3-D environment (Figs. 1-6).

As per claim 3, Nagamitsu discloses memory (18) for storing indexed sections of sound source patterns which would obviously imply a data structure being used for storing sections of sound sources and its propagation path information for efficient storage and computation (Figs. 5, 6, cols. 5-8).

As per claim 4, Nagamitsu discloses step of tracing propagation paths through the spatial environment step of representing sound environment surface as cell adjacent graph and traversing such graph in order to simulate sound in the environment (col. 5, lines 60-63, for example).

As per claims 6-7, Nagamitsu discloses sound source and sound receiver are moving (cols. 10-11).

As per claim 8, Nagamitsu discloses impulse response and convolving the impulse response with a source signal to generate a spatialized output signal as claimed (Figs. 5-10, cols. 7-9).

As per claim 9, Nagamitsu discloses encoded data in spatial environment (Figs. 5-6, for example).

As per claim 10, Nagamitsu models acoustic reverberation paths between avatar locations such as in concert hall, for example (Background of the Invention).

As per claim 11, Nagamitsu discloses sound source data and propagation paths are encoded for structure sections and stored in memory (Figs. 5, 6, col. 5, lines 25-55), such structure sections with encoded information stored in memory are called data structure as

obviously known for those skilled in the computer computation art for effectively simulating

acoustic sound effects in spatial environment using the ray tracing techniques (col. 5, line 60 to

col. 6, line 2, for example). Nagamitsu also discloses assigning weight corresponding to the

arrival time, including early arrival time, for each sound ray in ray tracing (col. 8, lines 39-41).

As per claim 18, Nagamitsu discloses a sound environment simulator for measure of

sound wave effects with feature limitations very similar to the claimed invention (Abstract and

Summary of the Invention). According to Nagamitsu, the apparatus of modeling sound wave

propagation in the spatial 3-dimensional environment includes means for

computing wave propagation paths from sources to other regions in the spatial

environment (col. 5, lines 1-22, col. 6, line 16 to col. 7, line 45, for example),

generating at least reverberation or echo path between the source and a receiver based on

at least one computed wave propagation path as claimed (Figs. 9, 10, col. 8, line 49 to col. 9,

line 10, for example). Nagamitsu discloses impulse responses for each incident location, incident

direction, and sound bands (col. 8, line 66 to col. 9, line 10, for example) and ordering of sound

waves (col. 10, lines 47-52) based on weight corresponding to the arrival time for sound ray

(col. 8, lines 39-41). Nagamitsu does not expressly disclose priority order of computing wave

propagation as claimed.

Practitioner in the art at the time of the invention was made could have found Nagamitsu

disclosure of ordering of reflection of incident waves, assigning weight values corresponding to

wave arrival time to each sound ray, and computing wave responses for all incident waves for

each direction as in cols. 8, 9, and 10 would obviously imply the claimed limitation of priority

order of computing wave propagation in order to reduce memory capacity and improve simulator

faster in sound environment as disclosed in col. 10, lines 2-11, lines 30-35, lines 43-45, for

example.

As per claim 19, Nagamitsu discloses the apparatus for modeling acoustic wave

propagation or sound reverberation in 3-D environment (Figs. 1-6).

As per claim 20, Nagamitsu discloses memory (18) for storing indexed sections of sound

source patterns which would obviously imply a data structure being used for storing sections of

sound sources and its propagation path information for efficient storage and computation

(Figs. 5, 6, cols. 5-8).

As per claim 21, Nagamitsu discloses step of tracing propagation paths through the

spatial environment step of representing sound environment surface as cell adjacent graph and

traversing such graph in order to simulate sound in the environment (col. 5, lines 60-63, for

example).

As per claims 23 and 24, Nagamitsu discloses sound source and sound receiver are

moving (cols. 10-11).

As per claim 25, Nagamitsu discloses means for performing impulse response and

convolving the impulse response with a source signal to generate a spatialized output signal as

claimed (Figs. 5-10, cols. 7-9).

As per claim 26, Nagamitsu discloses reverberation paths between source and receivers

are encoded and stored in computer memory. Such memory could include a data structure for

storing encoded data structure in an efficient manner for ray tracing techniques (Figs. 5-6, col. 5,

lines 60-64, for example).

As per claim 27, Nagamitsu models acoustic reverberation paths between avatar locations

such as in concert hall for multiuser environment, for example (Background of the Invention).

As per claim 28, Nagamitsu discloses sound source data and propagation paths are

encoded for structure sections and stored in memory (Figs. 5, 6, col. 5, lines 25-55), such

structure sections with encoded data are stored in memory are called data structure as obviously

known in the computer computation art for effectively simulating acoustic sound effects in

spatial environment. Nagamitsu also discloses assigning weight corresponding to the arrival time

for each sound ray in ray tracing (col. 8, lines 39-41).

6.   Claims 5, and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Nagamitsu et al., US patent no. 5,467,401 as applied to claims 1, and 18, respectively above, and

further in view of Reed et al., 5,574,466.

As per claim 5, Nagamitsu discloses sound simulation method for virtually simulating

sound effect in spatial environment (see claim 1 rejection above). Nagamitsu does not expressly

disclose beemtree with tree node and node priority value as claimed. Such features are well-

known in the art. In fact, Reed teaches data structure as tree being used in ray tracing (Figs.

2, 14, col. 3, line 50 to col. 4, line 9, col. 5, lines 8-63, col. 7, lines 1-15, for example), with tree

nodes, nodal arrival time or priority, etc. as claimed, to improve memory storage and

computation speed in ray tracing techniques.

This would motivate practitioner in the related art at the time of the invention was made to combine Reed teaching of tree data structure to store model data into ray tracing techniques as disclosed in Nagamitsu to improve computation and memory storage as taught in Reed in the Background of the Invention.

As per claim 22, Nagamitsu discloses sound simulation method for virtually simulating sound effect in spatial environment (see claim 18 rejection above). Nagamitsu does not expressly disclose beemtree with tree node, cell boundary, and node cell priority value as claimed. Such features are well-known in the art. In fact, Reed teaches data structure for modeling wave propagation in spatial environment as beam tree for ray tracing (Figs. 2, 14, col. 3, line 50 to col. 4, line 9, col. 5, lines 8-63, col. 7, lines 1-15, for example), with beam tree characteristics such as tree node locations, nodal arrival time for priority, cell boundary for environment corners, etc. as claimed, to improve memory storage and computation speed in ray tracing techniques.

This would motivate practitioner in the related art at the time of the invention was made to combine Reed teaching of tree data structure to store model data into ray tracing techniques as disclosed in Nagamitsu to improve computation and memory storage as taught in Reed in the Background of the Invention.

7.   Claims 12-17, and 29-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nagamitsu, Patent no. 5,467,401, in view of Reed et al., US patent no. 5,574,466.

As per claim 12, Nagamitsu discloses method of modeling coherent wave propagation in a spatial environment with feature limitations substantially similar to the claimed invention (Abstract and Summary of the Invention). According to Nagamitsu, the modeling method includes steps of

constructing sound source data by tracing beam bidirectionally because ray tracing techniques trace directive sounds from various sound sources (col. 5, line 59 to col. 6, line 12) between a plurality of sound sources, including a pair of sound sources, in the spatial environment (col. 7, line 63 to col. 8, line 7, for example),

and computing a filter response for at least one path between the pairs (cols. 7-8). Nagamitsu does not expressly disclose a specific data structure like tree as claimed. Such feature is well-known in the art. In fact, Reed teaches method and system for encoding wave propagation data in tree structure for used in ray tracing (Figs. 2, 14, col. 5, lines 8-63, for example) to improve memory storage and computation speed in ray tracing techniques.

This would motivate practitioner in the related art at the time of the invention was made to combine Reed teaching of tree data structure to store model data into ray tracing techniques as disclosed in Nagamitsu to improve computation and memory storage as taught in Reed in the Background of the Invention.

As per claim 13, Nagamitsu discloses sound source simulation between an audio source and a receiver location (Summary of the Invention).

As per claim 14, Reed teaches tree structure for storing traced ray (Figs. 2 and 14), and such beamtree could be encoded for reverberation paths as disclosed in Nagamitsu.

As per claim 15, Reed teaches tracing adjacent cells or nodes in the structure beam tree in a spatial environment.

As per claim 16, Nagamitsu discloses computing reverberation source paths between the plurality of sources (cols. 5 and 6), and Reed teaches tracing beam tree in ray tracing techniques (Fig. 2, 14, col. 5, lines 8-63, col. 7, lines 15-65, for example).

As per claim 17, Nagamitsu discloses such limitations in virtual sound simulation in spatial regions as claimed.

As per claim 29, Nagamitsu discloses apparatus for modeling coherent wave propagation in a spatial environment with feature limitations substantially similar to the claimed invention (Abstract and Summary of the Invention). According to Nagamitsu, the modeling apparatus includes means for

constructing sound source data by tracing beam bidirectionally because ray tracing techniques traces directive sounds from various sound sources (col. 5, line 59 to col. 6, line 12) between a plurality of sound sources, including a pair of sound sources, in the spatial environment (col. 7, line 63 to col. 8, line 7, for example),

and computing a filter response for at least one path between the pairs (cols. 7-8). Nagamitsu does not expressly disclose a specific data structure, for example, tree as claimed. Such feature is well-known in the art. In fact, Reed teaches method and system for modeling wave propagation in tree data structure for ray tracing, such tree structure is called beamtree (Figs. 2, 14, col. 5, lines 8-63, for example) to improve memory storage and computation speed in ray tracing techniques.

This would motivate practitioner in the related art at the time of the invention was made

to combine Reed teaching of tree data structure to store model data into ray tracing techniques as

disclosed in Nagamitsu to improve computation and memory storage as taught in Reed in the

Background of the Invention.

As per claim 30, Nagamitsu discloses sound source simulation between an audio source

and a receiver location (Summary of the Invention).

As per claim 31, Reed teaches tree structure or beam tree structure for modeling traced

ray (Figs. 2 and 14), and encoding for reverberation paths in sound simulation environment as

disclosed in Nagamitsu.

As per claim 32, Reed teaches tracing adjacent cells or nodes via structure of beam tree

in a spatial environment which could include the claimed limitation for tracing adjacent cells.

As per claim 33, Nagamitsu discloses computing reverberation source paths between the

plurality of sources (cols. 5 and 6), and Reed teaches tracing beam tree in ray tracing techniques

(Fig. 2, 14, col. 5, lines 8-63, col. 7, lines 15-65, for example).

As per claim 34, Nagamitsu discloses such limitations in virtual sound simulation in

spatial regions as claimed.

Conclusion

8.   The prior art made of record and not relied upon is considered pertinent to

applicant's disclosure.

1.   US patent no. 5,491,644, issued to Pickering et al., on Feb. 1996

2.   US patent no. 5,715,412, issued to Aritsuka et al., on Feb. 1998

3.   US patent no. 5,963,459, issued to Burnett et al., on Oct. 1999

4.   US patent no. 6,343,131 B1, issued to Huopaniemi, Jyri, on Jan. 2002

9.   Any inquiry concerning this communication or earlier communications from the examiner

should be directed to Thai Phan whose telephone number is (703) 305-3812.

Any inquiry of a general nature or relating to the status of this application should be

directed to the Group receptionist whose telephone number is (703)305-3900.

Any response to this action should be mailed to:

Commissioner of Patents and Trademarks

Washington, D.C. 20231

or faxed to:

(703) 746-7239, (for formal communications intended for entry)

Or:

(703) 746-7240 (for informal or draft communications, please label

"PROPOSED" or "DRAFT")

Hand-delivered responses should be brought to Crystal Park II, 2121 Crystal

Drive, Arlington. VA., Sixth Floor (Receptionist).

May 5, 2003

Thai Phan
Patent Examiner
AU 2123